DIFFERENTIAL UBV PHOTOMETRY OF β LYRAE, IV

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This is the fourth in a series of papers which, as was explained in Papers I, II, and III (Lovell and Hall 1970; Lovell and Hall 1971; Landis, Lovell, and Hall 1973), should be helpful in understanding the changes in the light curve of β Lyrae. Between March and October of 1972, 82 differential UBV observations were obtained by Lovell and 107 by Landis.

The equipment, observing techniques, and data reduction procedures were all the same as those described in Paper III except that Lovell did observe in the ultraviolet during 1972 and used the ψ transformation coefficient given by Lovell and Hall (1973).

The standard deviation of observations made on the same night is only about ± $0^m.01$ in each color for both Lovell and Landis. This is the same deviation reported in Paper III. However it should be mentioned that, if the observations made on a given night were rather close together in time and hence at nearly the same value of differential air mass, errors of ± $0^m.1$ in the assumed mean extinction coefficients could be causing the external error of each differential measure to be larger than the standard deviation, perhaps as large as ± $0^m.2$.

The observations are listed in Tables I and II (where the columns have the same meaning as in Paper III) and are also plotted in Figure 1. Lovell's diaphragm 146 arc seconds in diameter included the light of β^2 Lyrae, but we have removed this light from his differential magnitudes in Table I and from his points in Figure 1, taking the magnitudes of β^2Lyrae to be $\underline{V} = 7^m.22$, $(\underline{B}-\underline{V}) = -0^m.08$, $(\underline{U}-\underline{B}) = -0^m.49$ and the magnitudes of γ Lyrae to be $\underline{V} = 3^m.35$, $(\underline{B}-\underline{V}) = -0^m.05$, $(\underline{U}-\underline{B}) = -0^m.09$.

REFERENCES

Lovell, L. P., Hall, D. S. 1970, P. A. S. P., 82, 345 (Paper I).
_____. 1971, ibid. 83, 357 (Paper II).
_____. 1973, ibid. 84, 131.
Landis, H. J., Lovell, L. P., Hall, D. S. 1973, P. A. S. P. 84, 133 (Paper III).

TABLE I

DIFFERENTIAL UBV OBSERVATIONS (LOVELL)

JD(hel.) 2441000+	Phase	ΔV	ΔB	ΔU	JD(hel.) 2441000+	Phase	ΔV	ΔB	ΔU
395.863	.9558	+0.392	+0.437	-0.003	523.608	.8354	+0.055	+0.115	-0.358
.874	.9566	+0.389	+0.432	-0.002	.616	.8360	+0.050	+0.110	-0.364
.885	.9575	+0.382	+0.439	-0.015	.626	.8367	+0.101	+0.154	-0.311
396.823	.0300	+1.005	+0.980	+0.676	524.597	.9119	+0.143	+0.183	-0.287
402.870	.4977	+0.454	+0.446	+0.057	.606	.9125	+0.138	+0.179	-0.316
.878	.4983	+0.401	+0.435	+0.044	.614	.9132	—	+0.189	-0.304
407.826	.8810	+0.159	+0.271	-0.217	534.790	.7002	+0.137	+0.187	-0.286
.835	.8817	+0.167	+0.222	-0.232	.800	.7009	+0.128	+0.189	-0.288
.844	.8824	+0.176	+0.208	-0.238	.809	.7016	+0.120	+0.166	-0.301
416.804	.5753	+0.579	+0.621	+0.177	535.589	.7619	+0.072	+0.133	-0.351
.815	.5762	+0.608	+0.630	+0.175	.598	.7626	+0.072	+0.107	-0.350
.823	.5768	+0.568	+0.618	+0.172	.608	.7634	+0.072	+0.125	-0.346
425.799	.2710	+0.197	+0.228	-0.245	539.586	.0711	+0.889	+0.991	+0.579
.806	.2716	+0.234	+0.244	-0.211	.600	.0721	+0.876	+0.960	+0.514
.814	.2721	+0.194	+0.237	-0.207	.606	.0726	+0.867	+0.983	+0.532
426.800	.3484	+0.151	+0.211	-0.266	540.584	.1483	+0.471	+0.580	+0.179
.810	.3492	+0.152	+0.187	-0.250	.594	.1490	+0.463	+0.577	+0.157
.820	.3500	+0.151	+0.212	-0.241	.602	.1496	+0.451	+0.554	+0.106
447.718	.9661	+0.386	+0.439	+0.047	550.562	.9199	+0.173	+0.259	-0.230
.730	.9670	+0.365	+0.427	+0.046	.572	.9207	+0.169	+0.254	-0.237
.745	.9682	+0.390	+0.433	-0.055	558.569	.5392	+0.481	+0.558	+0.109
448.748	.0458	+0.952	+1.065	+0.719	559.676	.6248	+0.367	+0.402	-0.029
.759	.0466	+0.953	+1.051	+0.713	.686	.6256	+0.373	+0.396	-0.041
.770	.0475	+0.957	+1.067	+0.710	.695	.6263	+0.374	+0.422	-0.028
449.735	.1222	+0.747	+0.853	+0.559	565.634	.0856	+0.885	+0.985	+0.578
.745	.1229	+0.782	+0.871	+0.529	.644	.0864	+0.902	+1.004	+0.577
.752	.1235	+0.724	+0.845	+0.526	.656	.0873	+0.883	+0.976	+0.567
462.769	.1302	+0.704	+0.773	+0.424	566.634	.1629	+0.392	+0.463	+0.002
463.698	.2020	+0.300	+0.322	-0.081	.643	.1636	+0.397	+0.440	+0.014
.707	.2027	+0.299	+0.322	-0.127	.652	.1643	+0.379	+0.435	0.000
.718	.2036	+0.281	+0.325	-0.114	570.637	.4725	+0.268	+0.313	-0.132
479.686	.4389	+0.280	+0.277	-0.185	.647	.4733	+0.289	+0.371	-0.105
.695	.4392	+0.278	+0.265	-0.207	.654	.4738	+0.288	+0.351	-0.107
.706	.4401	+0.261	+0.280	-0.172	577.756	.0231	+0.751	+0.839	+0.442
495.572	.6748	+0.215	+0.294	-0.121	.766	.0238	+0.768	+0.822	+0.455
.682	.6756	+0.238	+0.293	-0.166	.777	.0247	+0.821	+0.846	+0.464
.692	.6764	+0.233	+0.278	-0.169	580.599	.2430	+0.161	+0.192	-0.269
500.689	.0628	+0.772	+0.894	+0.498	.608	.2436	+0.143	+0.178	-0.286
.697	.0635	+0.830	+0.888	+0.477	.618	.2444	+0.160	+0.199	-0.298
.704	.0640	+0.774	+0.915	+0.497	581.588	.3194	+0.129	+0.155	-0.339
					.596	.3206	+0.136	+0.182	-0.337
					.606	.3208	+0.138	+0.185	-0.319

TABLE II

DIFFERENTIAL UBV OBSERVATIONS (LANDIS)

JD(hel.) 2441000+	Phase	ΔV	ΔB	ΔU	JD(hel.) 2441000+	Phase	ΔV	ΔB	ΔU
422.877	.0451	+1.121	+1.183	+0.775	558.548	.5377	+0.462	+0.506	+0.032
.883	.0455	+1.100	+1.196	+0.779	.553	.5380	+0.463	+0.509	+0.048
425.890	.2781	+0.204	+0.183	-0.233	560.545	.6921	+0.203	+0.238	-0.197
.898	.2786	+0.186	+0.251	-0.246	.550	.6925	+0.213	+0.238	-0.205
.903	.2791	+0.196	+0.258	-0.246	568.537	.3102	+0.119	+0.180	-0.323
430.874	.6635	+0.336	+0.404	-0.066	.541	.3105	+0.116	+0.178	-0.331
.880	.6640	+0.344	+0.401	-0.078	572.533	.6193	+0.430	+0.485	+0.008
431.867	.7403	+0.205	+0.267	-0.216	.538	.6196	+0.443	+0.483	+0.014
.873	.7408	+0.207	+0.276	-0.213	573.590	.7009	+0.206	+0.250	-0.233
432.847	.8161	+0.140	+0.202	-0.293	.595	.7013	+0.193	+0.242	-0.233
.854	.8167	+0.135	+0.183	-0.312	574.589	.7782	+0.092	+0.143	-0.364
433.857	.8942	+0.180	+0.244	-0.235	.593	.7785	+0.097	+0.147	-0.326
.863	.8947	+0.199	+0.248	-0.219	580.534	.2380	+0.180	+0.246	-0.287
441.864	.5135	+0.448	+0.513	+0.089	.539	.2384	+0.147	+0.197	-0.339
.869	.5138	+0.453	+0.515	+0.078	.548	.2391	+0.160	+0.209	-0.290
442.858	.5904	+0.553	+0.606	+0.136	582.537	.3929	+0.163	+0.217	-0.284
.865	.5909	+0.551	+0.599	+0.136	.541	.3933	+0.171	+0.225	-0.289
446.848	.8988	+0.144	+0.201	-0.261	585.570	.6275	+0.381	+0.462	-0.019
.851	.8992	+0.158	+0.209	-0.269	.576	.6280	+0.373	+0.450	-0.019
447.836	.9753	+0.431	+0.556	+0.156	591.575	.0919	+0.927	+1.022	+0.534
469.782	.6726	+0.259	+0.328	-0.160	.581	.0923	+0.903	+1.009	+0.532
.787	.6730	+0.272	+0.320	-0.165	592.521	.1651	+0.419	+0.486	+0.009
470.777	.7495	+0.164	+0.227	-0.282	.525	.1654	+0.393	+0.480	+0.006
.782	.7499	+0.171	+0.227	-0.284	593.519	.2422	+0.140	+0.212	-0.322
473.791	.9826	+0.468	+0.532	+0.138	.524	.2426	+0.142	+0.193	-0.324
.796	.9830	+0.479	+0.552	+0.109	594.514	.3192	+0.138	+0.188	-0.321
482.706	.6721	+0.278	+0.276	-0.145	.519	.3196	+0.140	+0.205	-0.323
.710	.6725	+0.273	+0.334	-0.150	596.518	.4742	+0.302	+0.358	-0.113
483.713	.7500	+0.164	+0.246	-0.264	596.522	.4745	+0.298	+0.347	-0.125
.718	.7504	+0.162	+0.240	-0.255	598.525	.6294	+0.387	+0.422	+0.005
490.722	.2921	+0.122	+0.175	-0.307	.531	.6299	+0.389	+0.430	-0.018
.727	.2925	+0.130	+0.183	-0.303	.533	.6304	+0.384	+0.427	-0.044
491.685	.3665	+0.137	+0.204	-0.281	599.535	.7075	+0.176	+0.246	-0.203
.689	.3669	+0.142	+0.203	-0.288	.541	.7079	+0.195	+0.256	-0.247
492.749	.4488	+0.229	+0.292	-0.186	600.514	.7832	+0.138	+0.184	-0.323
492.754	.4492	+0.239	+0.306	-0.190	.518	.7836	+0.132	+0.186	-0.320
497.727	.8338	+0.119	+0.162	-0.299	601.519	.8609	+0.137	+0.197	-0.300
.732	.8342	+0.114	+0.149	-0.328	.522	.8612	+0.142	+0.204	-0.297
499.674	.9844	+0.433	+0.545	+0.109	608.509	.4016	+0.202	+0.267	-0.237
502.658	.2152	+0.220	+0.317	-0.181	.516	.4021	+0.212	+0.273	-0.251
.662	.2155	+0.215	—	-0.198	612.499	.7101	+0.180	+0.248	-0.270
504.647	.3690	+0.121	+0.182	-0.314	.503	.7104	+0.179	+0.234	-0.280
.651	.3694	+0.135	+0.205	-0.295	615.560	.9469	+0.267	+0.352	-0.117
507.678	.6034	+0.524	+0.560	+0.083	.565	.9473	+0.263	+0.340	-0.151
.682	.6037	+0.525	+0.572	+0.098	630.485	.1012	+0.951	+1.081	+0.603
519.687	.5322	+0.491	+0.512	+0.078	.491	.1016	+0.960	+1.069	+0.605
.693	.5326	+0.475	+0.519	+0.076	634.491	.4110	+0.237	+0.284	-0.198
533.575	.6063	+0.456	+0.537	+0.030	.496	.4114	+0.229	+0.277	-0.215
.581	.6067	+0.455	+0.498	+0.034	637.484	.6425	+0.389	+0.435	-0.037
551.560	.9972	+0.608	+0.697	+0.267	.490	.6429	—	+0.442	-0.035
.561	.9973	+0.578	+0.669	+0.252	639.486	.7972	+0.106	+0.181	-0.318
.567	.9977	+0.601	+0.659	+0.266	.490	.7976	+0.122	+0.189	-0.302
.571	.9981	+0.575	+0.633	+0.276					
553.596	.1547	+0.405	+0.515	+0.018					
.600	.1550	+0.406	+0.518	+0.029					

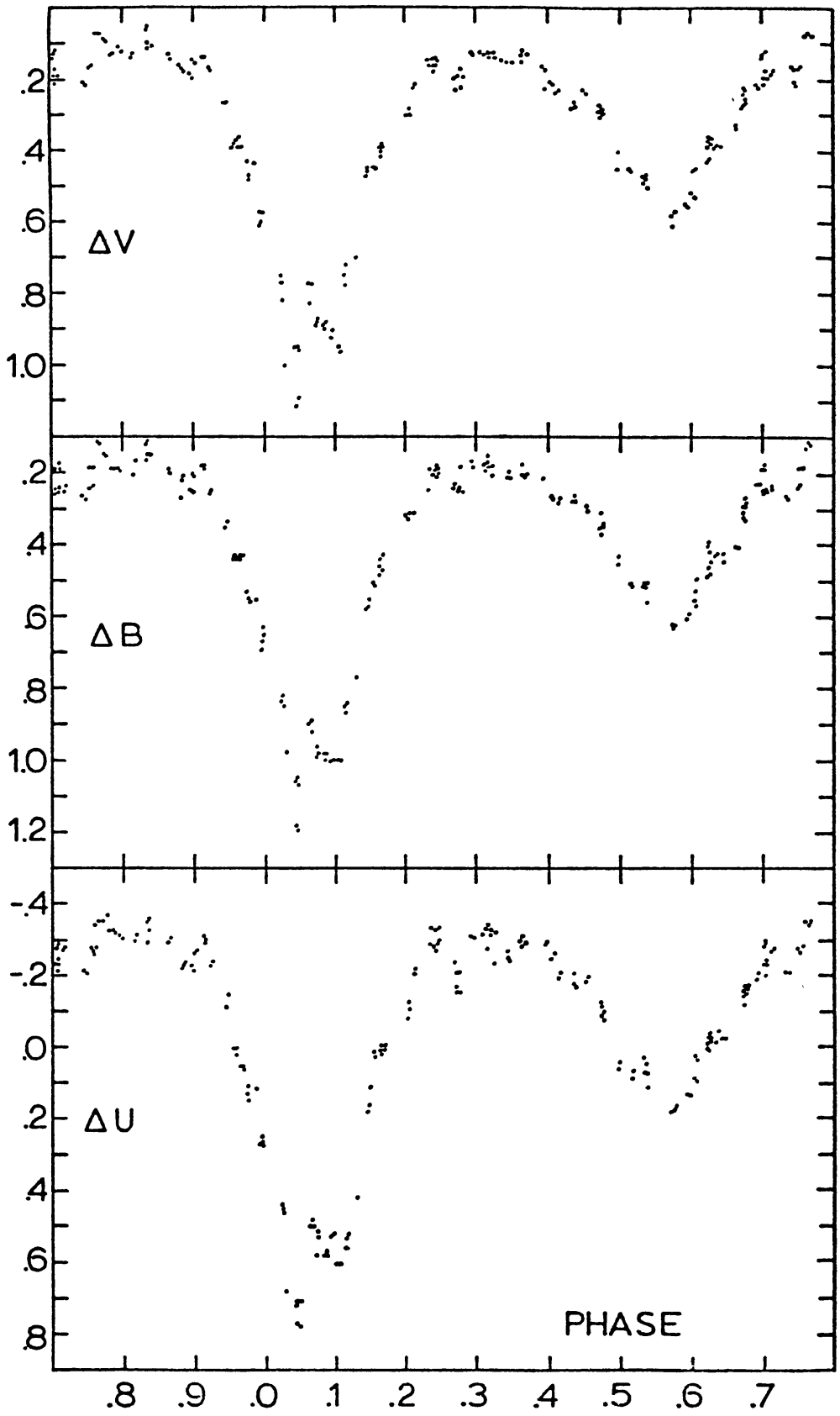

Figure 1. Differential UBV observations of β Lyrae in the sense β Lyrae minus γ Lyrae.